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Description

Adhesive sheet strip

10 The invention relates to single-sidedly or double-sidedly pressure-sensitively adhesive sheet strips which may be redetached without residue or destruction by extensive stretching in the bond plane.

Prior Art

15 Highly elastically or plastically extensible self-adhesive tapes which may be redetached without residue or destruction by extensive stretching in the bond plane (also referred to below as strippable self-adhesive tapes) are known from US 4,024,312, DE 33 31 016, WO 92/11332, WO 92/11333, DE 42 22 849, WO 95/06691, DE 195 31 696, DE 196 26 870, DE 196 49 727, DE 196 49 728, DE 196 49 729, DE 197 08 366, and DE 197 20 145.

20 They are frequently used in the form of single-sidedly or double-sidedly pressure-sensitively adhesive sheet strips (adhesive tape strips, adhesive strips),
25 which preferably have a nonadhesive grip tab region from which the detachment process is initiated. Particular applications of such self-adhesive tapes may be found, inter alia, in DE 42 33 872, DE 195 11 288, US 5,507,464, US 5,672,402, and WO 94/21157; specific embodiments are described, for example, in
30 DE 44 28 587, DE 44 31 914, WO 97/07172, DE 196 27 400, WO 98/03601, and DE 196 49 636, DE 197 20 526, DE 197 23 177, DE 297 23 198, DE 197 26 375, DE 197 56 084, DE 197 56 816, WO 99/31193, WO 99/37729, and WO 99/63018.

Preferred areas of use of the abovementioned strippable adhesive sheet strips include, in particular, the residuelessly and nondestructively redetachable fixing of light to moderately heavy articles in the home, workplace, and office segments. In these applications they replace conventional fastening means, such as drawing

pins, roundhead needles, thumbtacks, nails, screws, conventional self-adhesive tapes, and liquid adhesives, to name but a few. Key to the successful use of the abovementioned adhesive sheet strips is not only the quick and easy bonding and the secure hold they provide for the envisaged period of bonding but also the possibility of the residueless and nondestructive redetachment of bonded articles.

It should be borne in mind in particular here that for the functional capacity of the adhesive strips in the redetachment process it is necessary to ensure reliable holding of the grip tab throughout this process.

Commercial products currently on the market (e.g., tesa® Powerstrips®, tesa® Powerstrips® mini, tesa® Poster-Strips from Beiersdorf AG, 3M Command® Adhesive strips from 3M, and Plastofix® Formule Force 1000 adhesive strips from Plasto S. A.) all have grip tab regions which are presented in a wide variety of different forms, such as, for example, adhesive regions of the adhesive sheet strips that are covered with thin polymer films (e.g., tesa® Powerstrips®), thin polymer films protruding centrally from the adhesive composition in the plane of the adhesive sheet strip (e.g., Plastofix® Formule Force 1000 adhesive strips), and intermediate carriers without a coating of adhesive composition (e.g., 3M Command® adhesive strips). Polymer films with the aforementioned utility may be improved in their usefulness by a reduction in UV transmittance and may have been treated on the side facing the adhesive composition in such a way as to assist tearing-free redetachment by extensive stretching. Such films may also be colored (e.g., tesa® Powerstrips® Freestyle).

The aforementioned and further characterizations of the grip tabs are described, inter alia, in WO 92/11 333, DE 42 22 849, DE 44 31 914, DE 196 27 400, WO 98/03 601, DE 196 49 636, and DE 198 49 199.

Disadvantages of the Prior Art

A disadvantage of the above-described products which are available on the market is that it is easy for the grip tab to slip free in the course of extensive stretching. Although DE 44 31 914 describes not release coating the side of the grip tab film which faces the skin, this does not achieve a sufficiently reliable grip.

Indeed, where the grip tab slips out from the fingers of the user, the process of redetachment by extensive stretching in the bond plane is critically interrupted. Not uncommonly, interruptions of this kind in the redetachment process or equally harmful regripping lead to tearing: a failure which the user rightly associates with, ultimately, a lack of product quality.

A further disadvantage in the prior art is that during the redetachment process the user is forced to grip very firmly in order to be able to hold the grip tab. Not uncommonly, this firm hold is achieved with the aid of fingernails, at the edge of which the stretched adhesive sheets may then tear: a grave disadvantage.

It was therefore an object of the invention to develop self-adhesive strips, redetachable without residue or destruction by extensive stretching in the bond plane, which are more readily gripped, especially those which have an increased grip (frictional force) in the grip tab regions, thereby favoring a secure hold during the process of redetachment by extensive stretching.

Description of the Invention

This object is achieved by means of adhesive sheet strips as described in more detail in the claims. Attention is drawn expressly to the claims in order to avoid repetition.

In particular, the surfaces of the grip tab regions are specially characterized, e.g., coated with silicones (e.g., platinum catalyzed, addition crosslinked, solvent

free types), preference being given to compounds which in use have a deformable (plastic and/or elastic) character. Similar effects are also achieved, for example, by using ethylene-vinyl acetate copolymers or polyurethane compounds, for example. In addition, the surfaces may be slightly tacky, but in particular with only a low initial tack, in order to prevent dirt particles gaining an adequate hold in the course of bonding. The abovementioned substances may be present either over the entire area or else partially (in the form of stripes or dots, for example) on the grip tab.

Suitable processes for producing such surfaces according to the invention when using backing materials (e.g., PET sheet) include, for example, surface coating technology, printing technology, including screen printing technology, and also coextrusion. Alternatively, the grip tab surfaces according to the invention may also be designed using a material which can be used as a grip tab region without further surface modification (e.g., EVA sheets and polyurethane sheets).

A further possibility for increasing the grip of the grip tab is to provide the grip tab surfaces with coarse and fine structures by means, for example, of etching, grinding or embossing. Structured surfaces of this kind exhibit high grip tab grip especially when such modifications are performed on materials which are already furnished with high frictional forces.

All of the variants described feature a markedly higher grip tab grip than in the prior art.

Adhesive sheets

Adhesive sheets furnished with grip tab regions having good grip in accordance with the invention comprise, in particular, those in accordance with US 4,024,312, DE 33 31 016, WO 92/11333, DE 42 22 849, WO 95/06691, DE 196 26 870, DE 196 49 727, DE 196 49 728, DE 196 49 729, and DE 197 08 366, which use pressure-sensitive adhesive (PSA) compositions based on elastomer/resin mixtures. In particular, the adhesive sheets used in accordance

with the invention use PSA compositions based on polymeric dienes, such as natural rubber, synthetic polyisoprene, and polybutadiene, for example. Furthermore, these adhesive sheets use PSA compositions based on styrene block copolymers. Preferred styrene block copolymers include those containing elastomer blocks based on 1,3-dienes, such as polyisoprene, polybutadiene, and isoprene-butadiene copolymers, for example, and partially or fully hydrogenated analogs of the aforementioned systems. Furthermore, these adhesive sheets use PSA compositions based on random copolymers of conjugated dienes and other polymerizable compounds, such as, for example, styrene-butadiene copolymers or acid functionalized styrene-butadiene copolymers, to name but a few. Furthermore, adhesive sheets to be protected against tearing in accordance with the invention use PSA compositions based on polyolefinic elastomers. In accordance with the invention it is also possible to use adhesive sheets having PSA compositions based on mixtures of abovementioned elastomers and also based on blends of abovementioned elastomers with further polymers.

Double-sidedly/single-sidedly pressure-sensitively adhering self-adhesive tapes

Grip tab regions according to the invention may be used both for single-sidedly and for double-sidedly pressure-sensitively adhering self-adhesive tapes that are redetachable without residue or destruction by extensive stretching. In this case, single-sidedly pressure-sensitively adhering self-adhesive tapes may also, for example, be furnished on one side only with a grip tab region according to the invention.

Production of modified grip tab regions for examples

Grip tab regions according to the invention, in the case of modification by coating, were in each case produced on the basis of a sheet carrier of polyethylene terephthalate (25 µm PETP/B, Laufenberg GmbH) (# A to D) or by using sheets formed into webs (# E).

Particularly suitable grip tab regions are those in accordance with
 DE 42 22 849, DE 44 31 914, EP 747027, DE 196 27 400, DE 194 49 636, and
 DE 198 49 199.

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Production of use-compliant adhesive sheet specimens for examples

On the commercial product tesa® Powerstrips® Art. 58000, the grip tab films
 were removed on both sides and placed at the same position on both sides and in
 the same section size by web-formed sheets modified in accordance with the
 invention.

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Test methods

Determination of frictional properties in accordance with DIN 53375-B

The test setup is chosen so that the frictional properties of surfaces according
 to the invention of grip tab regions for investigation is investigated with respect to a
 skinlike surface (here, PE foam ALVEOLIT TEE 0800.55 from ALVEO). For this
 purpose, testing was carried out as described in DIN 53375. The friction block had
 a contact area of 10 cm² (5 cm x 2 cm). The friction partner ALVEOLIT TEE
 0800.55 was chosen here instead of the felt covering described in the standard, in
 order to create a surface which is skinlike particularly in its compression and
 deformation behavior. The total mass of the friction block was 100 g. The force
 was measured using a spring balance.

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Determination of behavior in a realistic redetachment process

The adhesive sheet specimens residuelessly redetachable by stretching
 (L x W = 50 x 20 mm) were bonded to glazed tiles in such a way that the grippable
 region ends with the edge of the bonded joint. For this purpose the adhesive strip
 (its top side covered with release paper) was placed on the tile and pressed on by
 rolling over it 6 times (at 10 m/s) using a 2 kg pressing roller. Baseplates of

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commercially available tesa® Powerstrips® system hooks have their release paper removed and were then stuck on using pressure (10 s, 100 N) acting uniformly and vertically on the whole adhesive composition in such a way that the entire adhering region of the adhesive strip was covered.

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Specimens prepared in this way were assessed within 24 h after storage at room temperature by removing the adhesive strips manually from the bond joint by pulling stretchingly on the nonadhering grip region (the maximum angle to the bond face during detachment was 5°, the typical detachment speed was about 10 cm/s). An assessment was made of whether the adhesive strip was detachable without tearing or residue in the manner described without the grip tab slipping from the user's fingers.

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Examples

Using the test setup described, in accordance with DIN 53375, the following frictional properties were detected on selected surfaces :

#	Surface type	Surface Structure	Static frictional force F_s (cN)
A	Unmodified PET	Smooth	60
B	Silicone varnish A*	Smooth	20
C	Silicone varnish B*	Smooth	210
D	EVA primer containing 28% VAc*	Smooth	240
E	Metallocene cat. EVA*	Perforated sheet	> 580

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*Features of the base materials used:

Silicone release varnish A condensation crosslinked, solventborne, 0.25 g/m²

Silicone release varnish B addition crosslinked with Pt catalysis, solvent free, 0.20 g/m²

EVA primer containing 28% VAc from surface protective film, 5 g/m²

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Perforated sheet of metallocene-cat. EVA, Flexfil X-16047 (Tredegar)

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Behavior in a realistic redetachment process (10 tests each, 2 users) :

#	Frequency of slippage of the grip tab (%)	Consequences
A	50 (once each/test)	35% tearing**
B	60 (once each/test) + 20 (twice each/test)	65% tearing**
C	5 (once each/test)	No tearing
D	0	No tearing
E	0	No tearing

**Primarily as a result of regripping after the grip tab had slipped from the user's fingers. Use-compliant adhesive sheets according to the invention that are redetachable by extensive stretching adhere immediately in such cases, prior to regripping, on near-lying surfaces, so that in the subsequent recommenced stretching process there is severe distortion and, consequently, tearing of the adhesive sheets.

Clear advantages result in the realistic redetachment behavior of adhesive sheet specimens which have been appropriately finished in accordance with the invention with high frictional force levels (= grip) in the grip tab regions.